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MOKELE-MBEMBE: PROXIMATE ANALYSIS OF ITS SUPPOSED FOOD SOURCE

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ABSTRACT: Speculation continues about Mokele-Mbembe, a supposed genus of sauropod reported over the last 200 years to have survived in the Central African swamp-forests. A 1981 scientific expedition into the Likoula swamps of the People's Republic of Congo failed to make sightings, but did return with "molombo" fruit, reputed to be a staple food of the animal. Proximate chemical analysis of the fruit, and nutritional comparison with large mammals, suggest that a diet more diverse than only molombo fruit would be required by the animal.

INTRODUCTION

Reports of large, semi-aquatic herbivores of a kind not known to zoology have come out of the Central African swamp-forests for about 200 years (Heuvelmans 1978, Ley 1948, Mackal 1980). Some observers have speculated that the animals in question, known in the Congo Republic as Mokele-Mbembe (but reported in neighboring countries under other African names), may represent a surviving sauropod genus. Others have proposed that, if the animals exist at all, they may be unclassified reptiles or mamals, but with a less spectacular heritage.

There are two consistent features of Mokele-Mbembe reports which are of some interest to the nutritional scientist. One is morphology, which involves a bulky, elephant-like body, a long, slender neck, and a small head. Learning about the physiological affinities of such an animal would be of some significance to zoology, as would be knowledge of its protein/calorie consumption.

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FIG. 1.—"Molombo," a fruit from a Central African liana of the genus *Landolphia,* said to be a food source for Mokele-Mbembe.

The other consistent feature in the reports is that the animal is an herbivore. Although Mokele-Mbembe is said to be dangerous, attacking dugouts and killing the occupants, its diet is supposedly strictly vegetarian. (There is no inconsistency in this; hippos, which are vegetarian, have also been known to attack the occupants of dugouts.) Its main food staple, according to the African inhabitants of the area, is derived from "molombo," the Lingala name for a liana belonging to the genus *Landolphia,* which has white flowers, apple-sized fruit, and a sweet, white latex sap (Fig. 1).

A scientific expedition headed by Roy P. Mackal of the University of Chicago penetrated the Likouala swamps, in the northern part of the People's Republic of Congo, in late 1981. Fruit specimens of one of the many *Landolphia* species were secured by expedition members, and a small quantity of these were submitted to the authors for nutritional evaluation. Of particular interest was whether *Landolphia* fruit could, in fact, meet the nutritional requirements of large, mobile herbivores in closed-canopy, tropical swamp-forest. The purpose of this paper is to consider the nutritional implications of the data obtained by proximate analysis.

METHOD

The fruit had been transported in a sealed plastic container, with formaldehyde as a preservative. They were round, firm, and all about 35 mm in diameter. They were combined to make one composite sample. Several weeks had elapsed from the time of collection, so no significance could be assigned to "as-is" moisture content. The sample was pulverized in a Waring blendor, dried for 18 hours in a vacuum oven at 60°C, and ground to −30 mesh in a laboratory model Wiley mill. Analytical data are reported as the means of triplicate determinations.

Proximate analyses were obtained by the following established methods: crude lipid content using 2:1 (v/v) chloroform/methanol by Soxhlet extraction; crude protein content by the microKjeldahl method; and ash content by firing in an electric muffle furnace at 600°C. Acid detergent fiber and acid detergent lignin were determined by the method of Van Soest (1963), and gross energy was obtained by calorimetry using a Parr oxygen bomb.

RESULTS

Proximate composition of the molombo fruit collected is shown in Table 1, with data for hyacinth, alfalfa, and pear included for comparison.

DISCUSSION

A theoretical discussion of a wild animal not fully defined as to size, eating habits, and classification as mammal or sauropod is difficult at best. Based upon a single food item collected, it is impossible to determine if the animal is omnivorous or herbivorous. The chemical characteristics of the molombo fruit are such that most animals could consume it, because it is relatively low in fiber (8.5%) and protein (7.9%), and has a high carbohydrate content (72.2%) (Table 1).

This food item, if representative of typical food consumed, could be used by either a ruminant or non-ruminant animal, because the fiber content is low enough to allow a non-ruminant animal to utilize it. However, the protein content is very low for a non-ruminant animal, and on the lower

TABLE 1.—Proximate composition of molombo fruit (*Landolphia* sp.).[a]

	Crude lipid, %	Crude protein, %	Ash, %	AD fiber, %	AD lignin, %	Carbohydrate,[b] %	Gross energy, kcal/kg
Molombo	4.1	7.9	5.8	8.5	1.5	72.2	4,211
Hyacinth[c]	1.6	16.4	7.5	37.2	–	37.3	4,200[d]
Alfalfa[c]	2.1	20.2	8.0	29.4	–	40.3	4,270
Pear[c]	2.1	6.1	4.0	23.8	–	63.9	3,900

[a] Data reported on a dry weight basis.
[b] Values determined by difference.
[c] National Academy of Sciences (1972).
[d] Calculated gross energy.

extreme for a ruminant animal. The high carbohydrate content of the "fruit" would furnish the bulk of the calories whether the animal were ruminant or non-ruminant. The chemical composition of molombo does not aid in distinguishing whether Mokele-Mbembe is a ruminant or non-ruminant animal. If the animal in question is a surviving sauropod, we can only speculate about its dietary habits.

Estimation of the caloric intake per day of the animal can be approached by making certain assumptions. An elephant weighing 3,672 kg consumes 49,000 kcal per day, which could be provided by 12.3 kg of alfalfa. (Alfalfa has approximately 4,270 kcal/kg as listed in Table 1.) A large unknown mammal of similar size could be expected to require approximately the same number of calories. Kleiber (1975) gives an equation for resting animals as follows:

$$\text{Resting Energy Metabolism} = 70 \times (W_{kg}^{0.75})$$

where W = weight.

It is uncertain whether this equation would apply to a sauropod. The protein intake requirement can be calculated from the following equation (Kleiber 1975):

$$\text{Minimum Protein} = 2 \times 70 \times \frac{(W_{kg}^{0.75})}{1{,}000} \times 6.25$$

The low concentration of protein in the fruit (7.9%) would not meet the requirement of a monogastric animal, and would be marginal for an adult ruminant. These calculations suggest that the animal would need to utilize more than molombo fruit as a nutritive source.

The comparison of molombo fruit with other known food sources listed in Table 1 emphasizes other differences. It is unusual to find an ingredient of animal diets that is as low in both fiber and protein as is molombo fruit. In this respect, it resembles the pear more closely than either the hyacinth or alfalfa, although the fiber level in pear is three times as high. Whether molombo fruit contains anti-nutritional factors and is actually palatable to animals remains to be answered. It is hoped that future expeditions will provide further information about Mokele-Mbembe and its dietary preferences.

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